-continued

$$\Rightarrow f(R') = -h \cdot \exp\{-(R - R_0)/\alpha\}$$

$$= -h \cdot \exp\left\{(R - R_0) \cdot \frac{\ln(0.05) \cdot \tan(1.5\theta)}{0.95h}\right\}$$

Actual curve equation of the contact hole is achieved.

Next, as mentioned above, at the location where the tangent slope of the particular point of the contiguous wall **132** is tan δ, the light leakage is acceptable, and the contrast ratio of the liquid-crystal display is qualified, and the aperture ratio and the contrast ratio are optimized. The equation of half of the second width of the metal layer along the first direction is:

$$\frac{\partial f(R')}{\partial R'} = \tan\delta = \frac{\partial}{\partial R'}\left\{-h \cdot \exp\left[R' \cdot \frac{\ln(0.05) \cdot \tan(1.5\theta)}{0.95h}\right]\right\} \tag{7}$$

$$\Rightarrow -h \cdot \exp\left[R' \cdot \frac{\ln(0.05) \cdot \tan(1.5\theta)}{0.95h}\right] \cdot \frac{\partial}{\partial R'}\left[R' \cdot \frac{\ln(0.05) \cdot \tan(1.5\theta)}{0.95h}\right] = \tan\delta$$

$$\Rightarrow \exp\left[R' \cdot \frac{\ln(0.05) \cdot \tan(1.5\theta)}{0.95h}\right] = \frac{-\tan\delta \cdot 0.95}{\ln(0.05) \cdot \tan(1.5\theta)}$$

$$\Rightarrow R' \cdot \frac{\ln(0.05) \cdot \tan(1.5\theta)}{0.95h} = \ln\left[\frac{-\tan\delta \cdot 0.95}{\ln(0.05) \cdot \tan(1.5\theta)}\right]$$

$$\Rightarrow R' \cdot \frac{0.95h}{\ln(0.05) \cdot \tan(1.5\theta)} \cdot \ln\left[\frac{-\tan\delta \cdot 0.95}{\ln(0.05) \cdot \tan(1.5\theta)}\right]$$

$$\Rightarrow R = R_0 + \frac{0.95h}{\ln(0.05) \cdot \tan(1.5\theta)} \cdot \ln\left[\frac{-\tan\delta \cdot 0.95}{\ln(0.05) \cdot \tan(1.5\theta)}\right]$$

Considering that ±3.8 is acceptable manufacturing tolerance, when the first width and the second width satisfy the following equation, the aperture ratio and the contrast ratio are optimized:

$$2 * \left\{\frac{L_2}{2} + \frac{0.95h}{\ln(0.5) \cdot \tan(1.5\theta)} \cdot \ln\left[\frac{-\tan\delta \cdot 0.95}{\ln(0.05) \cdot \tan(1.5\theta)}\right]\right\} - 3.8 \leq L_1 \leq 2 * \left\{\frac{L_2}{2} + \frac{0.95h}{\ln(0.05) \cdot \tan(1.5\theta)} \cdot \ln\left[\frac{-\tan\delta \cdot 0.95}{\ln(0.05) \cdot \tan(1.5\theta)}\right]\right\} + 3.8$$

In one embodiment, to achieve aperture ratio and contrast ratio balanced, the angle δ could be equal to 10 degrees. In another one embodiment, to achieve an improved aperture ratio (transmittance), the angle δ is smaller than 10 degrees, and the angle δ is greater than or equal to 5 degrees (5 degrees≤δ<10 degrees). In another one embodiment, to achieve an improved contrast ratio (low light leakage in dark state), the angle δ is greater than 10 degrees, and the angle δ is smaller than or equal to 20 degrees (10 degrees<δ≤20 degrees)

With reference to FIG. **2**A, the element substrate **100** further comprises a first conductive layer **140** disposed on the planarization layer **130** in the contact region, wherein the first conductive layer **140** is electrically connected to the metal layer **120** via the contact hole **131**. The first conductive layer **140** is made of transparent material or metal. In one embodiment, a second conductive layer **141** is disposed on the planarization layer **130** in the pixel region. The second conductive layer **141** can be the same with or different from the first conductive layer **140**.

FIG. **2**B shows another element substrate of an embodiment of the invention. With reference to FIG. **2**B, the metal layer **120** is a source electrode or a drain electrode of a driving element (TFT). The metal layer can contact with a semiconductor layer made of polycrystalline silicon, non-crystalline silicon or metal oxide. In one embodiment, the element substrate **100** further comprises a first insulation layer **138**, a second insulation layer **139** and a third insulation layer **170**. The first insulation layer **138** is located between the metal layer **120** and the substrate **110**. The first insulation layer **138** can be made of silicon oxide, silicon nitride, alumina nitride, or other transparent materials. The second insulation layer **139** is located between the metal layer **120** and the planarization layer **130**, wherein the contact hole **131** passing through the planarization layer **130** and the second insulation layer **139** to expose the metal layer **120**. The material of second insulation layer **139** could be the same with the first insulation layer **138**. The third insulation layer **170** is located between the first conductive layer **140** and the planarization layer **130**. The material of third insulation layer **170** could be the same with the first insulation layer **138**. FIG. **2**C shows another element substrate of an embodiment of the invention, wherein the third insulation layer **170** is located between the second conductive layer **141** and the planarization layer **130**.

FIG. **3**A shows the element substrate of the embodiment of the invention utilized in a liquid-crystal display **200**, which comprises an active area A and an peripheral area (B). FIG. **3**B shows detailed structures of portion **3**B is FIG. **3**A, wherein the liquid-crystal display **200** further comprises scan lines **201** (along the first direction X), data lines **202** (along the third direction Y), a semiconductor layer **203**, source electrodes **240**, a contact hole **231**, a hole bottom **233** of the contact hole, drain electrodes **204**, common electrodes **205** and pixel electrodes **210**, which are located in the active area A. In an embodiment of the invention, the metal layer **120** could be the source electrodes **240**, the drain electrodes **204**, the scan lines **201** or the signal lines **202**. The contact hole **231** defines a contact region, and the pixel region is adjacent to the contact region. FIG. **3**C shows the detailed structures of another one embodiment, wherein slits **206** of the pixel electrodes **210** extends along the third direction Y.

With reference to FIG. **2**A, in another one embodiment, the metal **120** comprises a first edge **121**, the first edge **121** vertically corresponds to a critical point **136** which is on the contiguous wall **132**, and the tangent slope of the contiguous wall **132** at the critical point **136** is tan δ (5 degrees≤δ≤20 degrees). The base point **135** is located at the point where the contiguous wall **132** is connected to the hole bottom **133**. The straight line L connects a reference point **134** and a base point **135**. An included angle θ is between a straight line L and a horizontal line. The metal layer **120** has a first width L1 along the first direction X, and the hole bottom **133** of the contact hole **131** has a second width L2 along the first direction X, wherein the first width and the second width satisfy the following equation:

$$2 * \left\{\frac{L_2}{2} + \frac{(1-p)h}{\ln(p) \cdot \tan(1.5\theta)} \cdot \ln\left[\frac{-\tan\delta * (1-p)}{\ln(p) \cdot \tan(1.5\theta)}\right]\right\} = L_1$$

L1 is the first width of the metal layer **120** along the first direction X, and L2 is the second width of the hole bottom **133** of the contact hole **131** along the first direction X, and p is an adjustable parameter, and 0<p≤0.1. By modifying the parameters above, the curvature and the shape of the contiguous wall **132** can be modified.

In the embodiments above, the contact hole is in the active area A. However, the invention is not limited thereby. The